

CLAIMS

What is claimed is:

1. A method of making a capacitor, comprising:
  - providing a bare metallic foil;
  - 5 forming a dielectric over the bare metallic foil, wherein forming the dielectric comprises:
    - forming a dielectric layer over the foil;
    - annealing the dielectric layer;
    - re-oxygenating the dielectric resulting from the annealing; and
  - 10 forming a conductive layer over the dielectric, wherein the metallic foil, the dielectric, and the conductive layer form the capacitor.
2. The method of Claim 1, wherein annealing comprises: annealing at a temperature in the range of about 800-1050°C.
3. The method of Claim 2, wherein annealing comprises: 15 annealing in an environment having an oxygen partial pressure of less than about  $10^{-8}$  atmospheres.
4. The method of Claim 2, wherein annealing results in a dielectric comprising crystalline barium titanate or crystalline barium strontium titanate.
- 20 5. The method of Claim 1, wherein forming a dielectric layer comprises:
  - providing a dielectric precursor solution comprising barium acetate and at least one of titanium isopropoxide and titanium butoxide.
6. The method of Claim 1, wherein the capacitor has a 25 capacitance density of at least 0.5 microFarad/cm<sup>2</sup>.
7. The method of Claim 1, wherein re-oxygenating the dielectric comprises:
  - re-oxygenating the dielectric at a temperature in the range of 450-700°C and an oxygen partial pressure in the range of  $10^{-2}$  to  $10^{-7}$  atmospheres.
- 30 8. The method of Claim 1, wherein providing a bare metallic foil comprises:
  - providing a bare copper foil.
9. The method of Claim 1, wherein providing a bare metallic foil 35 comprises:
  - providing a foil that has not been treated with organic additives.
10. The method of Claim 1, wherein the dielectric layer is applied to a first side of the foil, the method comprising:

forming a second dielectric layer on a second side of the foil opposite to the first side.

11. The method of Claim 1, wherein forming a dielectric comprises: forming a dielectric having a thickness in the range of about 0.2-  
5 2.0 microns.
12. The method of Claim 1, wherein forming a dielectric comprises: forming a doped dielectric.
13. The method of Claim 1, comprising: etching the conductive layer.
- 10 14. A capacitor formed by the method of Claim 1.
15. A method of making a capacitor, comprising: providing a metallic foil; forming a dielectric over the metallic foil, wherein forming a dielectric comprises:  
15 annealing at a temperature of greater than about 800°C in an environment having an oxygen partial pressure of less than about  $10^{-8}$  atmospheres;  
re-oxygenating the dielectric; and  
forming a conductive layer over the dielectric, wherein the  
20 metallic foil, the dielectric, and the conductive layer form the capacitor.
16. The method of Claim 15, wherein annealing comprises: annealing at a temperature in the range of about 800-1050°C.
17. The method of Claim 15, wherein annealing results in a dielectric comprising barium titanate or barium strontium titanate.
- 25 18. The method of Claim 15, wherein providing a metallic foil comprises:  
providing a bare copper foil.
19. The method of Claim 18, wherein providing a bare copper foil comprises:  
30 providing a copper foil that has not been treated with organic additives.
20. The method of Claim 15, wherein forming a dielectric comprises:  
forming a dielectric having a thickness in the range of about 0.2-2.0 microns.  
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21. The method of Claim 15, comprising: etching the conductive layer.
22. A capacitor formed by the method of Claim 15.

23. A method of making a capacitor, comprising:
  - providing a bare copper foil that has not been treated with organic additives;
  - forming a dielectric having a thickness in the range of about 0.2-2.0 microns over the copper foil, wherein forming a dielectric comprises:
    - annealing at a temperature in the range of about 800-1050°C in an environment having an oxygen partial pressure of less than about 10<sup>-8</sup> atmospheres, wherein the dielectric comprises at least one of barium titanate and barium strontium titanate;
    - re-oxygenating the dielectric at a temperature in the range of about 450-700°C; and
    - forming a conductive layer over the dielectric, wherein the metallic foil, the dielectric, and the conductive layer form a capacitor.
24. A capacitor formed by the method of Claim 23.
25. A method of making a printed wiring board, comprising:
  - forming one or more capacitors using any of the methods recited in claims 1, 15 or 23;
  - laminating the one or more capacitors with one or more laminate layers; and
  - forming connection circuitry, wherein the connection circuitry connects to one or more conductive layers or foils of the one or more capacitors.
26. The method of Claim 25, wherein forming connection circuitry comprises:
  - forming one or more conductive vias.
27. The method of Claim 25, comprising:
  - connecting one or more conductive layers to a voltage pin of an integrated circuit by way of the connection circuitry.
28. The method of Claim 25, comprising:
  - etching one or more conductive layers before forming connection circuitry.
29. The method of Claim 28, wherein etching forms two separate electrodes from a conductive layer.
30. A printed wiring board formed by the method of Claim 25.